

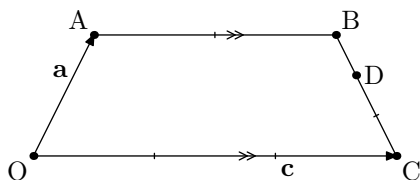
Figure 1 shows a 2D hexagonal lattice. Vectors a , b , c , d , e , f , g , and h are defined. Vector a is horizontal, b is vertical, c is horizontal, d is vertical, e is diagonal, f is diagonal, g is diagonal, and h is diagonal.

- (a) $\mathbf{c} = 2\mathbf{a}$
 (b) $\mathbf{d} = -2\mathbf{a} + 2\mathbf{b}$
 (c) $\mathbf{e} = 2\mathbf{b}$
 (d) $\mathbf{f} = -\mathbf{a} - 2\mathbf{b}$
 (e) $\mathbf{g} = -3\mathbf{b}$
 (f) $\mathbf{h} = -6\mathbf{a} + \mathbf{b}$

2. (a) $\mathbf{a} = -\mathbf{e} - 2\mathbf{f}$
- (b) $\mathbf{b} = \frac{1}{2}\mathbf{e}$
- (c) $\mathbf{c} = -2(\mathbf{e} + \mathbf{f}) = -2\mathbf{e} - 2\mathbf{f}$
- (d) $\mathbf{d} = 3\mathbf{e} + 2\mathbf{f}$
- (e) $\mathbf{g} = -\frac{3}{2}\mathbf{e}$
- (f) $\mathbf{h} = 6(\mathbf{e} + \mathbf{f}) + \frac{1}{2}\mathbf{e} = \frac{13}{2}\mathbf{e} + 6\mathbf{f}$

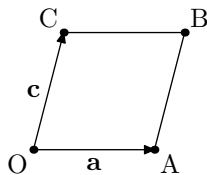
3. (a) $\mathbf{a} = -\frac{1}{6}(\frac{1}{3}\mathbf{g} + \mathbf{h}) = -\frac{1}{18}\mathbf{g} - \frac{1}{6}\mathbf{h}$
- (b) $\mathbf{b} = -\frac{1}{3}\mathbf{g}$
- (c) $\mathbf{c} = -\frac{1}{3}(\frac{1}{3}\mathbf{g} + \mathbf{h}) = -\frac{1}{9}\mathbf{g} - \frac{1}{3}\mathbf{h}$
- (d) $\mathbf{d} = \frac{1}{3}(\frac{1}{3}\mathbf{g} + \mathbf{h}) + \frac{2}{3}\mathbf{g} = \frac{7}{9}\mathbf{g} + \frac{1}{3}\mathbf{h}$
- (e) $\mathbf{e} = -\frac{2}{3}\mathbf{g}$
- (f) $\mathbf{f} = \frac{1}{6}(\frac{1}{3}\mathbf{g} + \mathbf{h}) + \frac{2}{3}\mathbf{g} = \frac{13}{18}\mathbf{g} + \frac{1}{6}\mathbf{h}$

4. (a)

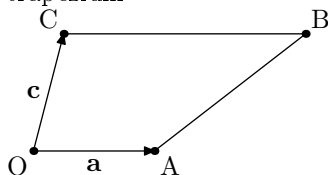


- $$\begin{aligned} \text{(b)} \quad \overrightarrow{OB} &= \overrightarrow{OA} + \overrightarrow{AB} = \mathbf{a} + \frac{2}{3}\mathbf{c} \\ \text{(c)} \quad \overrightarrow{AC} &= \overrightarrow{AO} + \overrightarrow{OC} = -\mathbf{a} + \mathbf{c} \\ \text{(d)} \quad \overrightarrow{CB} &= \overrightarrow{CO} + \overrightarrow{OB} = -\mathbf{c} + (\mathbf{a} + \frac{2}{3}\mathbf{c}) = \mathbf{a} - \frac{1}{3}\mathbf{c} \\ \text{(e)} \quad \overrightarrow{CD} &= \frac{2}{3}\overrightarrow{CB} = \frac{2}{3}(\mathbf{a} - \frac{1}{3}\mathbf{c}) = \frac{2}{3}\mathbf{a} - \frac{2}{9}\mathbf{c} \\ \text{(f)} \quad \overrightarrow{OD} &= \overrightarrow{OC} + \overrightarrow{CD} = \mathbf{c} + (\frac{2}{3}\mathbf{a} - \frac{2}{9}\mathbf{c}) = \frac{2}{3}\mathbf{a} + \frac{7}{9}\mathbf{c} \\ \text{(g)} \quad \overrightarrow{AD} &= \overrightarrow{AO} + \overrightarrow{OD} = -\mathbf{a} + (\frac{2}{3}\mathbf{a} + \frac{7}{9}\mathbf{c}) = -\frac{1}{3}\mathbf{a} + \frac{7}{9}\mathbf{c} \end{aligned}$$

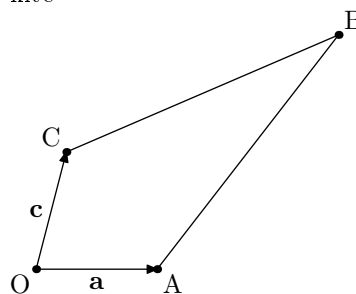
5. (a) rhombus



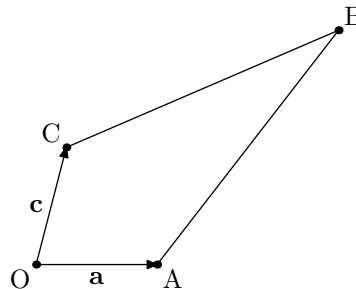
- (b) trapezium



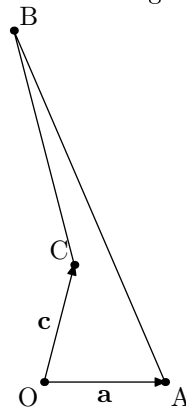
- (c) kite



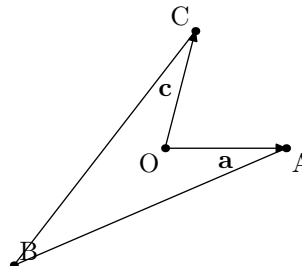
- (d) kite



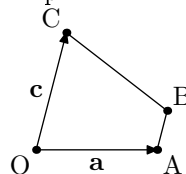
- (e) concave irregular



- (f) concave kite



- (g) trapezium



- 6.

